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The aquatic Coleoptera of Prince Edward Island, Canada: new records and faunal composition

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Abstract

The aquatic Coleoptera (Gyrinidae, Haliplidae, Dytiscidae, Hydrophilidae, Elmidae, Dryopidae, Heteroceridae) of Prince Edward Island, Canada is surveyed. Seventy-two species are now known to occur on Prince Edward Island, 26 of which are added to the island's faunal list. Three species, *Gyrinus aquiris* LeConte, *Oulimnius latiusculus* (LeConte), and *Helichus striatus* LeConte, are removed since there are no voucher specimens or published records to substantiate their presence. The name *Dineutus horni* is designated as an incorrect subsequent spelling of *Dineutus hornii* Roberts, 1895. The composition of the fauna is briefly discussed, both from regional and zoogeographic perspectives. There is only one introduced species, *Helophorus grandis* Illiger. Only one third of the aquatic fauna recorded on the neighbouring mainland has been found on Prince Edward Island, perhaps reflecting an island-associated diminution, the paucity of collecting, an area effect, or a combination of all these factors. The island faunas of Prince Edward Island, Cape Breton Island, and insular Newfoundland are compared. Prince Edward Island's is 36% smaller than the others, in contrast with the island's carabid fauna which is almost identical in magnitude with that of Cape Breton. This might reflect dispersal obstacles, the relative paucity of aquatic habitats on the island, or an insufficient collecting effort. Further research would be desirable, both to better discern the composition of the province's fauna, as well as to monitor the health of aquatic ecosystems in relation to anthropogenic activities.

Keywords

Coleoptera, Prince Edward Island, Canada, Gyrinidae, Haliplidae, Dytiscidae, Hydrophilidae, Elmidae, Dryopidae, Heteroceridae, biodiversity, aquatic invertebrates, nomenclature

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Introduction

Water beetles are important members of many freshwater aquatic ecosystems. Knowledge of this group of insects in the Maritime Provinces, in general, and on Prince Edward Island, in particular, has been fragmentary. Smetana (1974, 1980, 1985, 1988) made important contributions to knowledge of the Hydrophilidae of the region, Oygur and Wolfe (1991) included information from the Maritime Provinces in their revision of the genus *Gyrinus* (Gyrinidae), and Larson et al. (2000) comprehensively surveyed the Dytiscidae. In the various chapters pertaining to aquatic Coleoptera in Bousquet (1991), 45 species are reported as occurring on the island. Prince Edward Island has, however, been one of the most poorly known jurisdictions in Canada in terms of its beetle fauna. Collecting effort has been sparse, and much of the material extant in historical collections has remained unexamined and unidentified. The present study makes a contribution towards rectifying this situation by reporting the results of recent collecting of water beetles on the island, as well as the examination of existing historical materials in regional collections.

Methods and conventions

Voucher specimens of water beetles collected on Prince Edward Island and deposited in various collections were examined. Codens of collections (following Evenhuis 2007) referred to in the text are:

ACPE Agriculture and Agri-Food Canada, Charlottetown, Prince Edward Island, Canada
CGMC Christopher G. Majka Collection, Halifax, Nova Scotia, Canada
CNC Canadian National Collection of Insects, Arachnids, and Nematodes, Ottawa, Ontario, Canada
NSMC Nova Scotia Museum Collection, Halifax, Nova Scotia, Canada
GFC Garth Foster Collection, Ayr, Scotland
UPEI University of Prince Edward Island, Charlottetown, Prince Edward Island, Canada

Note: in some instances specimen records from the UPEI collection are given only for the province as a whole and for the time period 1974-83. These specimens, identified only by catalogue number on their pins, had their detailed collection data recorded in a ledger that was subsequently destroyed by fire. Geo-referenced location coordinates for all collection sites are provided in Appendix 1.

For the purposes of this treatment, northeastern North America is taken to consist of the following jurisdictions: Connecticut, Labrador, Massachusetts, Maine, New Brunswick, Newfoundland, New Hampshire, Nova Scotia, New York, Ontario, Prince Edward Island, Québec, Rhode Island, Saint-Pierre et Miquelon, and Vermont. The

classification employed follows that of Katovich (2002), Roughley (2000a, 2000b), Roughley and Larson (2000), Shepard (2002a, 2002b), and Van Tassell (2000).

Results

Seventy-two species of aquatic Coleoptera are known now to occur on Prince Edward Island. Twenty-six species are added to the list of the island's fauna and three species, *Gyrinus aquiris* LeConte, *Oulimnius latiusculus* (LeConte), and *Helichus striatus* LeConte, are removed from the island's faunal list (Table 1). Records for Prince, Queens, and Kings counties (which roughly represent the western, central, and eastern thirds of the island) are indicated. Three species, *Peltodytes edentulus* (LeConte), *Crenitis monticola* (Horn), and *Stictotarsus griseostriatus* (DeGeer), have been recorded only from the province as a whole, thus no further distributional data for them is reported in Table 1. Details of species added to or removed from the island's fauna follow.

Table 1. Aquatic Coleoptera of Prince Edward Island

	Counties			
Species	**Prince**	**Queens**	**Kings**	**Distribution in Northeastern North America**
GYRINIDAE				
Gyrininae				
Enhydrini				
Dineutus assimilis Kirby		1		NS, ON, PE, QC, RI
Dineutus hornii Roberts[1]		1	1	NB, NS, NY, ON, PE, QC, RI
Dineutus nigrior Roberts[1]			1	NB, NS, ON, PE, QC, RI
Gyrinini				
Gyrinus affinis Aubé[1]		1	1	LB, ME, NB, NF, NS, NY, ON, PE, QC
Gyrinus bifarius Fall[1]	1	1		LB, ME, NB, NF, NS, NY, ON, PE, QC
Gyrinus confinis LeConte[1]		1		LB, MA, NB, NF, NS, ON, PE, QC
Gyrinus fraternus Couper		1		NS, ON, PE, QC
Gyrinus lecontei (Hope)		1		MA, ME, NB, NS, ON, PE, QC, RI
Gyrinus sayi Aubé	1	1		LB, ME, NB, NF, NS, NY, ON, PE, QC, RI
HALIPLIDAE				
Haliplus canadensis Wallis			1	MA, NS, ON, PE, QC
Haliplus cribrarius LeConte		1	1	CT, LB, MA, ME, NB, NF, NH, NS, NY, ON, PE, QC

	Counties			
Species	**Prince**	**Queens**	**Kings**	**Distribution in Northeastern North America**
Haliplus immaculicollis Harris		1	1	LB, MA, ME, NB, NF, NH, NS, ON, QC, PE, PM, RI
Haliplus longulus LeConte		1		MA, NH, NB, NS, NY, ON, PE, QC, RI
Peltodytes edentulus (LeConte)[1]		•		MA, NB, NH, NS, ON, QC, PE, RI
Peltodytes tortulosus Roberts		1		NH, NS, ON, PE, QC
DYTISCIDAE				
Copelatinae				
Copelatus glyphicus (Say)			1	NF, NS, ON, PE, QC, RI
Laccophilinae				
Laccophilus m. maculosus Say	1	1		MA, NB, NH, NS, ON, QC, PE, RI
Hydroporinae				
Hyphydrini				
Desmopachria convexa (Aubé)		1	1	NB, NS, ON, PE, QC, RI
Bidessini				
Liodessus affinis (Say)			1	ME, NB, NF, NH, NS, ON, PE, QC, RI
Hydroporini				
Hydrocolus stagnalis (G. & H.)		1	1	ME, NB, NF, NH, NS, ON, PE, QC
Hydroporus dentellus Fall		1	1	LB, NB, NH, NS, NY, ON, PE, QC
Hydroporus niger Say		1	1	MA, NB, NF, NH, NS, NY, ON, PE, QC, RI
Hydroporus notabilis LeConte		1		LB, MA, NB, NF, NH, NS, ON, PE, QC
Hydroporus signatus Mannerheim			1	LB, NB, NF, NH, NS, ON, PE, QC, RI
Hygrotus impressopunctatus (Schaller)*	1	1	1	LB, ME, NB, NF, NH, NS, ON, PE, QC
Hygrotus picatus (Kirby)	1	1	1	LB, NB, NF, NS, NY, ON, PE, QC, RI
Hygrotus sayi Balfour-Browne	1		1	LB, MA, ME, NB, NF, NH, NS, NY, ON, PE, QC, RI, VT
Hygrotus turbidus (LeConte)		1	1	MA, NH, NS, NY, ON, PE, QC, RI

Species	Counties			Distribution in Northeastern North America
	Prince	Queens	Kings	
Nebrioporus rotundatus (LeConte)	1	1		LB, NB, NF, NS, ON, PE, QC, RI
Neoporus undulatus (Say)	1	1	1	LB, NB, NF, NS, NY, ON, PE, QC, RI
Neoporus dimidiatus (G. & H.)		1	1	LB, MA, ME, NB, NF, NH, NS, ON, PE, QC, RI
Stictotarsus griseostriatus (DeGeer)*		•		LB, ME, NB, NF, NS, ON, PE, QC, RI
Colymbetinae				
Agabini				
Agabus seriatus (Say)[1]		1		LB, MA, ME, NB, NF, NH, NS, ON, PE, QC
Agabus ambiguus (Say)			1	LB, NB, NF, NH, NS, ON, PE, QC, RI
Agabus anthracinus Mannerheim		1	1	LB, NB, NF, NH, NS, ON, PE, QC
Agabus phaeopterus (Kirby)		1		LB, NB, NF, NH, NS, ON, PE, QC
Agabus subfuscatus Sharp		1	1	NB, NS, ON, PE, QC, NF, LB
Agabus discolor (Harris)		1		NB, NS, ON, PE, QC, LB
Ilybius biguttulus (Germar)[1]		1	1	MA, ME, NB, NF, NH, NS, NY, ON, PE, QC, RI
Ilybius angustior (Gyllenhal)*		1		LB, NB, NF, NS, ON, PE, QC
Ilybius pleuriticus (LeConte)		1		CT, LB, MA, ME, NB, NF, NS, ON, PE, QC, RI, VT
Coptotomini				
Coptotomus longulus lenticus Hilsenhof			1	MA, ME, NH, NS, NY, ON, QC, NB, PE, RI
Colymbetini				
Colymbetes sculptilis Harris		1		LB, NB, NF, NH, NS, NY, ON, PE, QC, RI
Rhantus binotatus (Harris)		1		LB, ME, NB, NF, NH, NS, ON, PE, QC, RI
Rhantus wallisi Hatch[1]		1		LB, NB, NF, NH, NS, ON, PE, QC
Dytiscinae				
Dytiscini				
Dytiscus verticalis Say			1	MA, ME, NB, NH, NS, NY, ON, PE, QC, RI

	Counties			
Species	**Prince**	**Queens**	**Kings**	**Distribution in Northeastern North America**
Dytiscus harrisii Kirby[1]	1	1		LB, NB, NF, NH, NS, NY, ON, PE, QC
Dytiscus fasciventris Say[1]			1	LB, ME, NB, NH, NS, ON, PE, QC, RI
Dytiscus dauricus Gebler*	1	1	1	LB, ME, NF, NB, NS, NY, ON, PE, QC
Hydaticini				
Hydaticus aruspex Clark*	1		1	LB, NB, NF, NH, NS, ON, PE, QC
Aciliini				
Acilius mediatus (Say)[1]			1	MA, NB, NH, NS, ON, PE, QC, RI
Acilius semisulcatus Aubé	1	1	1	LB, MA, NB, NF, NH, NS, ON, PE, QC, RI
Graphoderus perplexus Sharp			1	LB, NB, NF, NH, NS, ON, PE, QC
HYDROPHILIDAE				
Helophorinae				
Helophorus grandis Illiger[1]†		1		ME, NB, NH, NS, NY, ON, PE, QC, VT
Helophorus orientalis Motschulsky[1]*	1	1		CT, MA, ME, NB, NH, NS, NY, ON, PE, QC, RI
Hydrophilinae				
Berosini				
Berosus striatus (Say)[1]			1	CT, MA, ME, NB, NH, NS, NY, ON, PE, QC, RI
Anacaenini				
Crenitis digesta (LeConte)[1]			1	MA, NB, NH, NS, NY, ON, PE, QC
Crenitis monticola (Horn)[1]		•		NB, NH, NS, PE, QC
Anacaena limbata (Fabricius)[1]		1		ME, NB, NF, NH, NS, NY, ON, PE, QC
Laccobiini				
Laccobius reflexipennis Cheary[1]		1		NB, NS, ON, PE, QC
Hydrophilini				
Enochrus ochraceus (Melsheimer)[1]		1		MA, ME, NB, NF, NH, NS, ON, PE, QC, RI
Enochrus hamiltoni (Horn)[1]		1	1	MA, ME, NB, NF, NH, NS, NY, ON, PE, QC, RI

	Counties			
Species	**Prince**	**Queens**	**Kings**	**Distribution in Northeastern North America**
Hydrobius fuscipes (Linnaeus)[1]*		1		CT, LB, MA, ME, NB, NF, NH, NS, NY, ON, PE, QC, RI, VT
Hydrobius melaenus (Germar)[1]			1	CT, MA, ME, NB, NH, NS, NY, ON, PE, QC, RI, VT
Hydrochara obtusata (Say)[1]	1	1		CT, MA, ME, NB, NH, NS, NY, ON, PE, QC, RI, VT
Tropisternus glaber Herbst[1]		1	1	MA, NB, NH, NS, NY, ON, PE, QC, RI
Tropisternus mixtus (LeConte)[1]			1	ME, NB, NH, NS, NY, ON, PE, QC, RI
ELMIDAE				
Elminae				
Elmini				
Dubiraphia quadrinotata (Say)	1			ME, NB, NH, NS, NY, ON, PE, QC, PE, RI, VT
Optioservus fastiditus (LeConte)		1	1	NB, NF, NH, NS, NY, ON, PE, QC
Optioservus ovalis (LeConte)		1		CT, LB, ME, NB, NH, NS, NY, ON, PE, QC, VT
Stenelmis crenata (Say)			1	MA, ME, NB, NF, NH, NS, NY, ON, PE, QC, RI
HETEROCERIDAE				
Heterocerinae				
Heterocerini				
Lantenarius brunneus (Melsheimer)	1			MA, ME, NH, NS, NY, ON, PE, QC, VT, RI
Totals	16	49	39	

Notes: Distributional information is derived from Chandler (2001), Dearborn and Donahue (1993), Downie and Arnett (1996), Larson et al. (2000), Larson and Roughley (1991), LeSage (1991a, 1991b, 1991c), Roughley (1991a, 1991b, 1991c), Sikes (2004), Smetana (1988), and unpublished data.

Regional Distribution: CT, Connecticut; LB, Labrador; MA, Massachusetts; ME, Maine; NB, New Brunswick; NF, insular Newfoundland; NH, New Hampshire; NS, Nova Scotia; NY, New York; ON, Ontario; PE, Prince Edward Island; QC, Québec; RI, Rhode Island; PM, Saint-Pierre et Miquelon; VT, Vermont.

[1], Species newly recorded from Prince Edward Island in the present account; *, Holarctic species; †, introduced Palaearctic species; •, provincial record (no locality or county information available).

Gyrinidae

Adults glide on the surface of ponds, lakes, and slow-moving rivers. They often congregate and swim rapidly in circles when alarmed, giving rise to their common name of whirligig. Adults are scavengers, feeding on dead and dying insects on the water surface, whereas larvae are predaceous on insect larvae and nymphs (Roughley 2000a).

Dineutus hornii Roberts, 1895

Kings Co.: Woodville Mills, 16.IX.2002, C.G. Majka, beaver pond, (3, CGMC). **Queens Co.:** Hillsboro River, 22.VI.1981, V. Friesen, (7, UPEI).

Dineutus hornii is newly recorded on Prince Edward Island. Species of *Dineutus* are found on the surface ponds, streams, lakes and rivers where they often form large rafts of individuals (Roughley 2000a).

Roberts (1895, pp 284) described this species as *Dineutus hornii*, the specific epithet spelled with two "i's". Subsequently some authors (i.e. Leng 1920; Roughley 1991b; Laplante et al. 1991; Dearborn and Donahue 1993; Downie and Arnett 1996; Chandler 2001) dropped the second "i", incorrectly spelling the name "*Dineutus horni*". Accordingly the name *Dineutus horni* is designated as an incorrect subsequent spelling of *Dineutus hornii* Roberts, 1895 (Article 33.3, ICZN 1999).

Dineutus nigrior Roberts, 1895

Kings Co.: Woodville Mills, 16.IX.2002, C.G. Majka, beaver pond, (1, CGMC).

Dineutus nigrior is newly recorded on Prince Edward Island.

Gyrinus aquiris LeConte, 1868

This species was reported from Prince Edward Island by Roughley (1991a), however, there are no voucher specimens from PEI in any collection consulted, nor was the species listed from the province by Fall (1922) or Oygur and Wolfe (1991). Consequently this species is removed from the faunal list of Prince Edward Island.

Gyrinus affinis Aubé, 1838

Kings Co.: Upton, 6.VI.1953, F.M. Cannon, (1, ACPE). **Queens Co.:** Charlottetown, 20.VI.1936, lily pond, UPEI; Vernon River, MacMillan's Pond, 3.VI.1970, R. Wenn, (1, UPEI).

Newly recorded on Prince Edward Island, this species is found in both lentic (58.8%) and lotic (41.2%) environments (Oygur and Wolfe 1991).

Gyrinus bifarius Fall, 1922

Prince Edward Island: locality data lost, 1974-1983, (1, UPEI). **Prince Co.:** Enmore, 21.V.1981, V. Friesen, (1, UPEI). **Queens Co.:** Mount Herbert, 31.V.1923, J.R. Mutch, (4, UPEI); Officer's Pond, 19.IX.1972, R. Edwards, (1, UPEI); Vernon River, MacMillan's Pond, 3.VI.1970, R. Wenn, (1, UPEI).

Newly recorded on Prince Edward Island, this species is found in both lentic (25.7%) and lotic (74.3%) environments (Oygur and Wolfe 1991).

Gyrinus confinis LeConte, 1868

Queens Co.: Vernon River, MacMillan's Pond, 3.VI.1970, R. Wenn, (1, UPEI).

Newly recorded on Prince Edward Island, this species is found primarily in lentic (91.7%) and occasionally lotic (8.3%) environments (Oygur and Wolfe 1991).

Haliplidae

Species of *Haliplus* and *Peltodytes* are found in small ponds, lakes, and quiet streams where they are frequently observed crawling in algal mats or other vegetation. Adults eat insect eggs, algae, and polyps of Hydrozoa whereas larvae are algophilous (Roughley 2000b).

Haliplus canadensis Wallis, 1933

Kings Co.: Dingwell's Mills, 26.VI.1985, L. LeSage, *Typha* zone along river, (1, CNC).

The species was recorded from Prince Edward Island by Vondel (2005), however, the collection data for this species have not previously been published.

Haliplus cribrarius LeConte, 1850

Kings Co.: Dingwell's Mills, 26.VI.1985, L. LeSage, *Typha* zone along river, (1, CNC); (no locality recorded), Kings, 13.VII.1988, Y. Bousquet, (1, CNC). **Queens Co.:** Vernon River, MacMillan's Pond, 3.VI.1970, R. Wenn, (1, UPEI).

The species was recorded from Prince Edward Island by Vondel (2005), however, the collection data for this species have not previously been published.

Haliplus longulus LeConte, 1850

Queens Co.: Brackley Beach, 26.VI.1985, L. LeSage, pond with filamenous algae and rotting vegetation, (1, CNC); Glenroy, 26.VI.1985, L. LeSage and R. Rocho, ditch along railroad, (1, CNC); Harrington, 27.VI.1985, L. LeSage, CNC; north of Pleasant Grove, 27.VI.1985, L. LeSage, (1, CNC).

The species was recorded from Prince Edward Island by Vondel (2005), however, the collection data for this species have not previously been published.

Peltodytes edentulus (LeConte, 1863)

Prince Edward Island: locality data lost, 1974-1983, (1, UPEI).

Peltodytes edentulus is newly recorded on Prince Edward Island.

Peltodytes tortulosus Roberts, 1913

Prince Edward Island: locality data lost, 1974-1983, (1, UPEI). **Queens Co.:** Vernon River, MacMillan's Pond, 3.VI.1970, R. Wenn, (1, UPEI); Cavendish, duneland trail, 4.IX.1999, T. Huxley, (1, GFC).

Dytiscidae

The Dytiscidae are a diverse and species-rich family of predaceous water beetles. They occur in many aquatic environments.

Agabus seriatus (Say, 1823)

Queens Co.: St. Patricks, 18.VIII.2002, C.G. Majka, along small stream in moss, (4, CGMC).

Newly recorded on Prince Edward Island, this species is found in springs, small, creeks occasionally along the margins of small rivers on mineral substrates or in mats of vegetation at the edge of flowing water (Larson et al. 2000).

Ilybius biguttulus (Germar, 1824)

Prince Edward Island: locality data lost, 1974-1983, (3, UPEI); **Kings Co.:** Valleyfield, 8.VII.1982, V. Friesen, by stream, (1, UPEI); **Queens Co.:** Charlottetown, 25.VI.1978, L.S. Thompson, (1, ACPE); Watervale, 29.VII.1970, R. Wenn, pond edge, (1, UPEI).

Newly recorded on Prince Edward Island, this species is found in sun-warmed, permanent lentic habitats in dense aquatic vegetation (Larson et al. 2000).

Rhantus wallisi Hatch, 1963

Queens Co.: locality data lost, VII.1979, L.S. Thompson, (1, ACPE).

Newly recorded on Prince Edward Island, this species is found in ponds in wooded areas, in sun-warmed, vegetation-rich margins (Larson et al. 2000).

Dytiscus harrisii Kirby, 1837

Prince Co.: Conway Narrows, 1.VIII.1970, U. Grigg, (1, NSMC); **Queens Co.:** Rice Pt., 12.VII.1983, M.E.M. Smith; Rice Pt., 13.VII.1983, M.E.M. Smith, (1, ACPE).

Newly recorded on Prince Edward Island, this species is found in shallow, warm permanent ponds and sedge marshes; specimens have also been taken in beaver ponds and at the edges of slow-moving boreal streams (Larson et al. 2000).

Dytiscus fasciventris Say, 1824

Prince Edward Island: locality data lost, 1974-1983, (5, UPEI); **Kings Co.:** Launching, 26.VIII.2003, C.G. Majka, (1, CGMC).

Newly recorded on Prince Edward Island, this species is found in a variety of ponds and marshes, in particular those with sedges; it is an avid predator of early spring mosquito larvae (Larson et al. 2000).

Acilius mediatus (Say, 1823)

Kings Co.: Souris, 29.VI.1993, L.S. Thompson, (1, ACPE).

Newly recorded on Prince Edward Island, this species is found in small forest pools, generally with bare, peaty bottoms; also in pools or adjacent to slow-flowing, brown-water streams (Larson et al. 2000).

Hydrophilidae

The aquatic members of the Hydrophilidae (the present account does not treat terrestrial species in the subfamily Sphaeridiinae) occur in a wide variety of aquatic environments, most of them in standing water and lentic habitats. Most species are scavengers, feeding on various kinds of decaying plant material, or else they feed on living plants such as algae (Smetana 1988).

Helophorus grandis Illiger, 1798

Queens Co.: Harrington, 14.VI.2004, C. Noronha, barley field, pitfall trap, (1, ACPE); Mount Herbert, Orphanage Pond, 30.V.1923, J.R. Mutch, (1, UPEI); West Royalty, 16.V.1983, L.S. Thompson, (1, ACPE); Wood Islands, 30.VI.2003, C.G. Majka, (1, CGMC).

Newly recorded on Prince Edward Island, this species favours temporary pools and muddy or weedy margins of ponds or lakes (Smetana 1988).

This adventive, Palaearctic species was first reported in North America by Darlington (1927). Smetana (1985) examined specimens from as early as 1904 from Montreal, although Brown (1940) noted a specimen from Chicoutimi, Québec, from the "second" collection of Provancher acquired sometime between 1877 and 1892. The earliest records from New Brunswick are in 1926 and from Nova Scotia in 1947 (Smetana 1985) so the collection from 1923 on Prince Edward Island establishes a new early timeline for *H. grandis* in the Maritime Provinces of Canada.

Helophorus orientalis Motschulsky, 1860

Prince Co.: Summerside, 19.VI.1992, M.E.M. Smith, potato field, pitfall trap, (5, ACPE); **Queens Co.:** New Glasgow, 13.VII.2002, C.G. Majka, meadow, (1, CGMC); St. Patricks, 18.VIII.2002, in wet moss beside small stream, (2, CGMC); St. Patricks, 14.VII.2002, in wet moss beside small stream, (9, CGMC).

Newly recorded on Prince Edward Island, this Holarctic species is found in a wide range of lotic and lentic environments, however, shallow temporary pools with plenty of vegetation are preferred (Smetana 1988).

Berosus striatus (Say, 1825)

Kings Co.: Woodville Mills, 30.VI.2003, C.G. Majka, beaver pond, (1, CGMC).

Newly recorded on Prince Edward Island, the species favours a wide variety of aquatic habitats favouring margins of deeper waters, particularly those with sandy bottoms and lots of debris (Smetana 1988).

Crenitis digesta (LeConte, 1855)

Kings Co.: Woodville Mills, 30.VI.2003, C.G. Majka, beaver pond, (4, CGMC).

Newly recorded on Prince Edward Island. It is found in both lotic and lentic environments, however, little is known about its habitat preferences (Smetana 1988).

Crenitis monticola (Horn, 1890)

Prince Edward Island: locality data lost, 1974-1983, (1, UPEI).

Newly recorded on Prince Edward Island, this species is found in both lotic and lentic environments, however, little is known about its habitat preferences (Smetana 1988).

"Anacaena limbata (Fabricius, 1792)"

Queens Co.: Millvale, 25.VI.2003, C.G. Majka, old mill pond, (2, CGMC); Millvale, 15.VIII.2004, C.G. Majka, old mill pond, (7, CGMC); St. Patricks, 18.VIII.2002, C.G. Majka, in wet moss beside small stream, (3, CGMC); St. Patricks, 14.VII.2002, C.G. Majka, in wet moss beside small stream, (3, CGMC); Vernon River, MacMillan's Pond, 3.VI.1970, R. Wenn, pond, (1, UPEI).

Newly recorded on Prince Edward Island, this species favours shallow standing water or margins of slow-flowing creeks with vegetation. It is also frequently found in semi-aquatic habitats (Smetana 1988).

The zoogeographic status of this species is unclear. Smetana (1988) regarded it as an apparently Palaearctic species introduced to North America. He also drew attention to the fact that it appeared that two species, *A. lutescens* (Stephens 1829) and A. *limbata,* were being confused under the name of *A. limbata* in North America. Albrecht Komarek (pers. comm.), who is revising the genus worldwide, points out that while *A. limbata* and *A. lutescens* are readily separable in Europe, North American specimens cannot unambiguously be assigned to either species. He believes that North American specimens may represent a separate, undescribed "cryptic" species in the *lutescens* complex. Morphological examinations cannot resolve the problem and it may require molecular phylogenetic analysis in order to discern the nature of this "species." Thus, in the present treatment, I provisionally treat it as a Nearctic species in the *lutescens* complex whose status has yet to be fully discerned.

Laccobius reflexipennis Cheary, 1971

Prince Edward Island: locality data lost, 1974-1983, (1, UPEI); **Queens Co.:** St. Patricks, 14.VII.2002, C.G. Majka, in wet moss beside small stream, (1, CGMC).

Laccobius reflexipennis is newly recorded on Prince Edward Island. No information on the bionomics of this species is available. Species of *Laccobius* are found in both lotic and lentic environments (Smetana 1988).

Enochrus ochraceus (Melsheimer, 1846)

Queens Co.: Watervale, 29.VII.1970, R. Wenn, aquatic vegetation, (1, UPEI).

Newly recorded on Prince Edward Island, this species prefers shallow water with abundant organic debris (Smetana 1988).

Enochrus hamiltoni (Horn, 1890)

Kings Co.: Woodville Mills, 30.VI.2003, C.G. Majka, beaver pond, (4, CGMC); **Queens Co.:** St. Patricks, 18.VIII.2002, C.G. Majka, in wet moss beside small stream, (2, CGMC); Wood Islands, 30.VI.2003, C.G. Majka, (1, CGMC).

Newly recorded on Prince Edward Island, this is a common species, abundant in a wide range of aquatic habitats (Smetana 1988).

Hydrobius fuscipes (Linnaeus, 1758)

Prince Edward Island: locality data lost, 1974-1983, (9, UPEI); **Queens Co.:** Watervale, 29.VII.1970, R. Wenn, aquatic vegetation, (1, UPEI); Harrington, 22.VI.1981, K. MacDonald, pond, (1, UPEI); West Royalty, 25.VI.1970, R. Wenn, light trap, North Rustico, 26.VI.2003, C.G. Majka, seashore, (1, CGMC).

Newly recorded on Prince Edward Island, this species is found in a wide range of aquatic habitats, particularly shallow, stagnant pools with plant debris; also in swampy habitats and *Sphagnum* bogs (Smetana 1988).

Hydrobius melaenus (Germar, 1824)

Kings Co.: Woodville Mills, 23.VII.2001, C.G. Majka, under stone beside small stream, (1, CGMC).

Newly recorded on Prince Edward Island, this species prefers running water habitats in places protected from currents (Smetana 1988).

Hydrochara obtusata (Say, 1823)

Prince Edward Island: locality data lost, 1974-1983, (2, UPEI); **Prince Co.:** Conway Narrows, 23.VIII.1970, U. Grigg, (1, NSMC); **Queens Co.:** Charlottetown, 1952, F.M. Cannon, (1, ACPE).

Newly recorded on Prince Edward Island, this species is found in a wide range of aquatic habitats, particularly in shallow water with rich vegetation. It is occasionally found under stones and wood at the edge of water (Smetana 1988).

Tropisternus glaber Herbst, 1797

Prince Edward Island: locality data lost, 1974-1983, (1, UPEI); **Kings Co.:** Woodville Mills, 16.VIII.2003, C.G. Majka, beaver pond, (1, CGMC); **Queens Co.:** Watervale, 29.VII.1970, R. Wenn, vegetation at edge of pond, (1, UPEI); locality data not recorded, VII.1979, L.S. Thompson, (1, ACPE).

Newly recorded on Prince Edward Island, this species frequents a wide-range of aquatic habitats, particularly lentic ones; often in marshes, swamps and bogs (Smetana 1988).

Tropisternus mixtus (LeConte, 1855)

Kings Co.: Woodville Mills, 30.VI.2003, C.G. Majka, beaver pond, (1, CGMC).

Newly recorded on Prince Edward Island, this species prefers cool and clean aquatic habitats, mostly in standing water; occasionally around the edges of running water (Smetana 1988).

Elmidae

Adults and larvae of the Elmidae are aquatic beetles found attached to rocks and other substrates. All the species on Prince Edward Island inhabit rapid, cool, and well-oxygenated streams where they feed on algae or detritus (Shepard 2002a).

Oulimnius latiusculus (LeConte, 1866)

This species was recorded from Prince Edward Island by LeSage (1991c), however, there are no voucher specimens in any collection consulted, and no published records of this species from the province. It is not listed as occurring in PEI by Brown (1983b). Laurent LeSage (pers. comm.) was unable to determine the source of the original report. Consequently this species is removed from the faunal list of Prince Edward Island.

Dryopidae

The aquatic species of this family found in North America are riparian where they are found crawling on various substrates in streams. Adults and larvae are herbivorous (Shepard 2002b).

Helichus striatus striatus LeConte, 1852

Although this species was recorded from Prince Edward Island by LeSage (1991b) there are no voucher specimens in any collection consulted, nor are there published records of this species from the province. It is not listed as occurring in PEI by Brown (1983a). Laurent LeSage (pers. comm.) was unable to determine the source of the original report. Consequently this species is removed from the faunal list of Prince Edward Island.

Heteroceridae

Adult heterocerids are commonly associated with riparian or other water-edge habitats where they excavate tunnels in sand or mud. They feed on algae, plankton, and organic matter (Katovich 2002).

Lantenarius brunneus (Melsheimer, 1844)

Prince Co.: Scales Pond, 12.VII.1988, Y. Bousquet, (1, CNC).

The species was recorded from Prince Edward Island by LeSage (1991a), however, the collection data for this species has not previously been published.

Discussion

Seventy-two species of water beetles are known from Prince Edward Island: ten gyrinids, six haliplids, 40 dytiscids, 14 hydrophilids, four elmids, and one heterocerid (Table 1). Of these, 26 species are newly recorded from Prince Edward Island: five gyrinids, one haliplid, six dytiscids, and 14 hydrophilids. Three species, *Gyrinus aquiris* LeConte, *Oulimnius latiusculus* (LeConte), and *Helichus striatus* LeConte, have been removed from the faunal list of Prince Edward Island since no voucher specimens or published records of these species on PEI could be located. There are records of 49 species from Queens County, 39 from Kings County and 16 from Prince County. These regional differences may be attributable to variations in collecting effort between these three portions of the province. Alternatively they may

reflect anthropogenic influences on the fauna since Prince County is the most heavily farmed portion of the island and in recent years the area has experienced a number of well-documented fish-kills due to pesticide run off.

The composition of the fauna reflects that of the Maritime Provinces as a whole. All the species found on Prince Edward Island have also been recorded in Nova Scotia, and all but six [*Dinetus assimilis* Kirby, *Haliplus canadensis* Wallis, *Peltodytes tortulosus* Roberts, *Copelatus glyphicus* (Say), *Hygrotus turbidus* (LeConte), and *Lantenarius brunneus* (Melsheimer)] have also been recorded in New Brunswick. The absence of these six species in the latter province is likely attributable to a lack of collection effort in New Brunswick, a relatively poorly investigated province within Canada in terms of its beetle fauna. In general, Prince Edward Island's fauna appears to be relatively homogeneous in composition. For example, of the 40 species of Dytiscidae found on Prince Edward Island, all are broadly distributed in the Atlantic Maritime Ecozone and all 40 are also found in the neighbouring Boreal Shield and Mixed Plains Ecozones (Larson et al. 2000).

The Nearctic component of the fauna is made up of 64 species (89%), the Holarctic component of 7 species (10%), and the introduced, Palaearctic component of one species (1%). The proportion of Holarctic Carabidae on Prince Edward Island (10.5%) is very similar (Majka et al. 2008), however, the proportion of adventive aquatic species in comparison to the overall adventive beetle fauna of Prince Edward Island (21.2%, unpublished data) is very slight.

As is typical in the case with island faunas, that of Prince Edward Island is diminished in comparison with that of the neighbouring mainland. Table 2 indicates that the 71 native water beetles found on Prince Edward Island are only 34% of the

Table 2. Composition of the Maritime Provinces aquatic Coleoptera

Family	NB	NS	CB	PEI	SI	MP	N	H	P	NF
Gyrinidae	18	20	9	9	0	24	23	1		10
Haliplidae	10	12	4	6	1	13	12	1		4
Dytiscidae	83	89	62	38	9	104	91	13		80
Hydrophilidae*	38	39	27	14	3	43	35	7	1	13
Hydraenidae	3	2	1	0	0	3	3			1
Elmidae	10	12	7	4	0	13	13			5
Dryopidae	3	2	0	0	0	3	2		1	1
Heteroceridae	5	4	1	1	1	6	6			0
Psephenidae	2	2	0	0	0	2	2			0
Total	172	182	111	72	14	211	187	22	2	114

Notes: NB, New Brunswick; NS, Nova Scotia; CB, Cape Breton; PEI, Prince Edward Island; SI, Sable Island; MP, Maritime Provinces; NF, insular Newfoundland; N, Nearctic; H, Holarctic; P, Palaearctic. Information is derived from Larson et al. (2000), Larson and Roughley (1991), LeSage (1991a, 1991b, 1991c), Roughley (1991a, 1991b, 1991c), Smetana (1988), Vondel (2005), and unpublished data. Information from Newfoundland is provided as a basis of comparison.

* excluding the Sphaeridiinae

total native mainland fauna (209 species) recorded in the Maritime Provinces. This may represent an island-associated diminution, the paucity of collecting, an area effect, or a combination of all these factors. In comparison, Majka and McCorquodale (2006) found that Prince Edward Island had 39% of the native Maritime Provinces fauna of Coccinellidae, Majka and Jackman (2006) found 40% of Maritime species of Mordellidae, Majka et al. (2007) found 32% of the native Maritime Cerambycidae, and Majka et al. (2008) found 49% of the native Maritime Carabidae that occur on Prince Edward Island.

In an examination of the native Carabidae of insular portions of Atlantic Canada, Majka et al. (2008) found that despite significantly different land areas, and different distances to the neighbouring continental mainland, the island faunas of Prince Edward Island (with a land area of 5,660 km^2 and 13 km from the mainland) and insular Newfoundland (with a land area of 111,390 km^2, 18 km distant from Labrador and 110 km from Cape Breton Island), are very similar (144 and 148 species respectively) despite differences in composition. The fauna of Cape Breton Island (with a land area of 10,311 km^2 and 1.5 km from the mainland) was 16% greater consisting of 170 species. In the case of aquatic beetles the situations is reversed. Table 2 indicates that the size of the Cape Breton and Newfoundland faunas are very similar (111 and 114 species respectively), whereas that of Prince Edward Island is 36% smaller consisting of 72 species. This difference could be due to several factors. It could be that the 13+ km wide Northumberland Strait has been a barrier to the dispersal of some species of aquatic Coleoptera; or the comparative lack of certain aquatic habitats on the island (which has only one freshwater lake and only relatively short watersheds); or the comparative lack of collecting on Prince Edward Island; or a combination of all these factors. There are, however, more than 800 millponds and a large number of springs on the island, many of which have been little or not at all investigated in terms of their aquatic beetle fauna. Further research in these habitats may yield additional species for the Prince Edward Island fauna.

As a rather different point of comparison, there have been 14 species of water beetles recorded on Sable Island (Table 2) which is circa 50 km^2 in area and is 160 km from the Nova Scotia mainland, although one of these species, *Hydrophilus triangularis* Say, was recorded only as a stray (Wright 1989).

Helophorus grandis is the only adventive water beetle found on Prince Edward Island and it is noteworthy that the collection from 1923 establishes a new early timeline for this species in the Maritime Provinces. Its collection in pitfall traps in agricultural fields may be indicative of a mode of introduction. Brown (1950) and Lindroth (1957) developed the theory that ships' dry ballast was a probable source of entry of many adventive ground-dwelling Coleoptera. It is possible that *H. grandis* might belong to the suite of adventive beetles that were introduced to North America via this mechanism.

Almost all of the knowledge that we have about the Prince Edward Island aquatic beetle fauna has been acquired recently. Of the 72 species recorded to date, all but eight (*Gyrinus affinis*, *Gyrinus bifarius*, *Laccophilus m. maculosus* Say, *Ilybius angustior*

(Gyllenhal), *Colymbetes sculptilis* Harris, *Rhantus binotatus* (Harris), *Acilius semisulcatus* Aubé, and *Helophorus grandis*) have first been recorded in the last 50 years (and these eight species have also been recorded subsequently). Thus the very limited historical information on these aquatic insects on the island means that it is not possible to determine historical population trends.

Conclusions

Despite the many additions to the faunal list of Prince Edward Island, the preceding account clearly represents only a preliminary treatment of the aquatic beetles of the province. The comparative dearth of collecting means that it is likely that additional species remain to be found. As well, the detailed distribution of these species on the island remains to be discerned. Yves Alarie at Laurentian University has been conducting surveys on Prince Edward Island and it is to be expected that the results of his work will yield additional information. As well, D. Giberson and her students at the University of Prince Edward Island, continue to investigate aquatic habitats, programs that will also doubtless yield important comparative information on aquatic insects and invertebrates. Prince Edward Island has experienced a long history of anthropogenic activities, which in the past 60 years has included the extensive use of insecticides and other biocides. Ongoing surveying of populations of aquatic insects such as beetles, may provide avenues of monitoring the health of aquatic ecosystems and of environmental change.

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Appendix 1. Coordinates of collection localities

	North latitude	**West longitude**
Brackley Beach	46º 24’	63º 11’
Cavendish	46º 29’ 48”	63º 23’ 17”
Charlottetown	46º 15’ 38”	63º 08’ 37”
Conway Narrows	46º 39’	63º 59’
Dingwell’s Mills	46º 31’ 27”	62º 26’ 35”
Enmore	46º 35	64º 02’
Glenroy	46º 21’ 10”	62º 34’ 22”
Harrington	46º 21’	63º 10’
Launching	46º 13’ 06”	62º 24’ 46”
Millvale	46º 24’ 35”	63º 25’ 19”
Mount Herbert	46º 13’ 49”	63º 02’ 14”
New Glasgow	46º 24’ 36”	63º 20’ 54”
North Rustico	46º 27’ 25”	63º 17’ 55”
Pleasant Grove	46º 22’ 05”	63º 03’ 37”
Rice Point	46º 08’	63º 15’
St. Patricks	46º 23’ 55”	63º 24’ 18”
Scales Pond	46º 20’	63º 36’
Souris	46º 21’	62º 15’
Summerside	46º 23’	63º 48’
Upton	46º 20’	63º 32’
Valleyfield	46º 08’	62º 44’
Vernon River	46º 12’	62º 51’
Watervale	46º 15’ 47”	62º 53’ 13”
West Royalty	46º 15’ 55”	63º 09’ 27”
Wood Islands	45º 57’ 27”	62º 44’ 55”
Woodville Mills	46º 14’ 26”	62º 30’ 46”